

Libby Asbestos Project
Draft Pilot Study
Whole-Home Dust Composite Sampling
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Revision 0



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1.0 Introduction

It is generally believed that Libby amphibole asbestos (LA) contamination in indoor dust is likely to be an important contributor to LA contamination in indoor air. However, it is expected that the level of LA in indoor dust (expressed as LA s/cm²) may not be constant throughout the house, but that there may be differences between sub-locations. If so, then collecting a “representative” sample of dust may be difficult.

Under current procedures (EPA 2003), two dust samples are collected from each house, each a composite consisting of three 100-cm² templates. Typically, the mean of the two samples is used to characterize the house. Thus, the estimate of dust loading for each house is based on a set of six templates. If dust loading is highly variable, six templates may not be adequate to accurately reflect the house-wide average dust concentration, and more templates may be needed to ensure the dust sample is representative.

Based on this concern, the purpose of this pilot study is three-fold:

- 1) Investigate whether or not there is substantial variability in LA levels in dust loading (f/cm²) as a function of the “accessibility” of an area. This is based on the hypothesis that dust in poorly accessible areas may tend to build up and retain higher levels of LA than dust in readily accessed (and frequently cleaned) areas. If so, then dust from less accessible areas might be a more important contributor to LA in indoor air than dust in readily accessible areas.
- 2) Investigate whether or not it is feasible to collect a 30-point composite dust sample without sampling problems associated with plugging the filter, decreased air flow rate, loss of loose dust in the cassette, etc. This will be assessed simply by field observations of flow rate and filter loading during the collection process. If flow rate begins to decrease as the number of templates increases, it will be concluded that it is not feasible, at least in some cases, to collect a 30-point composite on a single cassette. If this occurs, other sampling strategies (e.g., use of a larger area cassette, use of two or more cassettes, etc.) will be investigated.
- 3) Determine if collecting a dust sample based on a large number of templates (30) will yield a sample that is more nearly representative of the whole house than a set of 6 templates. If so, the degree of difference in the two approaches (30 point vs 6 point) will be assessed to determine whether the difference in representativeness is large enough to warrant the added time and effort associated with collection of a 30-point sample. This will be done in two ways:

- a) Investigate the degree of correlation between the results of the paired (same house) 30-point composites and the mean of two 3-point composites. If the correlation is strong, it will be assumed that the 30-point composites provides little additional information compared to the two 3-point approach.
- b) Investigate the degree of variation between field duplicates of 30-point and the mean of two three-point composites. That is, at a number of properties, two 30-point composites and two sets of two 3-point composites will be collected. The degree of between-duplicate variation will be assessed, and if there is little difference, it will be concluded that there is little additional merit in a 30-point approach compared to the current approach.

2.0 Selection of Sample Locations

Sample points will be collected from areas classified on a scale of accessibility. This scale was designed by the Environmental Protection Agency (EPA) and used during assessments of residential properties after the World Trade Center (WTC) attacks:

1. **Accessible** areas refer to locations where exposures are most likely to occur – places where dust accumulates and is encountered daily. This includes soft surfaces such as carpet (not including movable floor mats), upholstered furniture, floors and waist-high hard surfaces such as counter tops and non-carpeted floors.
2. **Infrequently accessed** areas refer to locations where dust may accumulate, but exposures are likely to occur infrequently. This includes areas on tops of shelves, entertainment centers, and refrigerators, etc.
3. **Inaccessible** areas refer to locations where dust may accumulate but exposures occur only rarely, such as behind refrigerators or other large infrequently moved objects.

To the extent possible, the sub-sample locations will be collected from each type of accessibility area as indicated below:

1. **Accessible** target areas, if present, and in order of priority:
 - a. Flooring (soft or hard surface) at the main entrance used by occupants
 - b. Flooring at the secondary or less heavily used entrance to the home
 - c. Flooring in the center of the living room or family room
 - d. Flooring in the center of bedrooms
 - e. Flooring in an acknowledged or evident route of high traffic (i.e., hallway or other thoroughfare)
 - f. Flooring in the kitchen
 - g. Kitchen counter tops

- h. Table tops in the following rooms: dining room, living room, or family room
 - i. Table tops (e.g., night stands, bureaus) in bedrooms
 - j. Window sills in the dining room, living room, or family room
 - k. Window sills in the bedrooms
 - l. Upholstered furniture in the living room
2. **Infrequent** target areas, if present, and in order of priority:
- a. Top of the refrigerator, when top is exposed
 - b. Top of bookshelves
 - c. Shelves of bookshelves
 - d. Top of the hot water heater
 - e. Beneath the sofa or other large pieces of furniture in the living room
 - f. Beneath the bed or other large pieces of furniture in bedrooms
 - g. Inside kitchen cabinets most frequently accessed
3. **Inaccessible** target areas, if present, and in order of priority:
- a. Beneath infrequently moved heavy appliances (e.g., refrigerator, washing machine, etc.)
 - b. Inside forced air floor or ceiling vents in the living room
 - c. Inside forced air floor or ceiling vents in the bedrooms
 - d. Corners of closets or other similar small areas not frequently accessed or cleaned

3.0 Sample Collection

At least 9 samples will be collected from each of 10 properties, as follows:

- **Accessible** target areas - one sample collected as a 12-point composite to represent all frequently accessed areas in the whole-home
- **Infrequent target areas** – one sample collected as a 12-point composite to represent all infrequently accessed areas in the whole home
- **Inaccessible** target areas – one sample collected as a 6-point composite to represent all inaccessible areas in the whole home. If 6 sub-sample locations cannot be identified, the total number of sub-samples can be reduced as long as all available areas are included in the sub-samples.
- **Whole-Home Composite** – one primary (parent) sample and one field duplicate sample, each a 30-point composite sample, will be collected across all areas of the home. These 30 templates should be collected in a random distribution from all living floors of the structure and will not follow the collection pattern detailed in Section 2.0.
- **High traffic areas** - one primary (parent) sample and one field duplicate per living floor, each a 3-point composite (EPA 2003)

- **Horizontal surfaces** - one primary (parent) sample and one field duplicate per living floor, each a 3-point composite (EPA 2003)

Each sub-sample point will cover 100 square centimeters (cm²) using disposable paper templates for measurement. The pilot study will be completed using sampling procedures described in ASTM 5755-03 (ASTM 2003) (unless noted).

- **Flow rates** – A flow rate of 2 liters/minute should be used for collection of all samples. Flow rates should be verified before sample collection begins and after each template is collected (especially in the case of the 30-point whole home multi-point samples). If a flow rate reduction is observed, collection of the sample on the existing cassette should be terminated and a new cassette should be substituted. These multiple cassettes will be combined the level of the laboratory to achieve the desired multi-point composite sample. When two or more cassettes are needed for a sample, all of the sampling cassettes will be given the same index ID number as the initial cassette.
- **Duration of sample collection** – Each of the template location collected as part of the **Accessible, Infrequent, Inaccessible** target areas, and **Whole-Home Multi-Point** will be collected for a duration of 30 seconds. The sampler should strive to make three collection passes per template during the 30 second interval.

The two 3-point composite samples should each be collected over 6 minutes, with each template collected in 2 minutes according to the current site protocol (EPA 2003).

- **Field Duplicates** – Each field duplicate sample specified above will be collected from a template placed immediately adjacent to the location of the parent sample.

4.0 Documentation

For the purposes of the pilot study, a field sample data sheet (Attachment 1) and logbook entry will be completed for each sample collected. For logbook entries, in addition to information required by CDM SOP 4-1 (Field Logbook Content and Control), the following will be recorded: Index (i.e., sample) ID, specific location and area (in cm²) of each sub-sample, total flow rate, sample time, and times/flow rates of all calibration checks.

Logbook documentation will also include a sketch of each floor of the home and show the approximate location of each template. Each template location will be illustrated with the following notations that indicate the type of target area and the template number:

- A₁, where “A” represents **Accessible** target areas and 1 represents the 1st template of the **Accessible** target area sample

- IF₂, where “IF” represents **Infrequent** target areas and 2 represents the 2nd template of the **Infrequent** target area sample
- IN₃, where “IN” represents **Inaccessible** target areas and 3 represents the 3rd template for the **Inaccessible** target area sample
- HT₁, where “HT” represents **High Traffic** target areas and 1 represents the 1st template of the **High Traffic** target area sample
- HS₂, where “HS” represents **Horizontal Surface** target areas and 2 represent the 2nd template of the **Horizontal Surface** target area sample

Individual start/stop times are not required to be recorded on the FSDS. The initial start time and flow rates will be recorded in the location provided on the FSDS. At the conclusion of sample collection the stop time and ending flow rate will be recorded in the location provided on the FSDS. Care should be taken by the sampler to insure the time required per sub-sample location is carefully monitored. Entries will be completed on the FSDS for total sample collection time.

When the sample collected is the field duplicate, the parent samples index ID number will be recorded in the field comments section of the FSDS.

5.0 Sample Custody

All pilot study dust samples will be handled in accordance with current project sample custody procedures.

6.0 Sample Analysis

Samples will be analyzed according to the protocol described in the current version of the Sampling and Analysis Plan for Indoor Air (SRC and CDM 2007), dated April 18th, and summarized below:

The target analytical sensitivity for dust samples collected as part of this pilot study will be 20 S/cm². Samples will be analyzed by the ISO TEM method 10312 (ISO 10312:1995(E)) with project specific modifications LB-000016, LB-000019, LB-000029, LB-000029a, LB-000030, LB-000053, and LB-000066b (CDM 2003). All asbestos structures (including not only LA but all other asbestos types as will) having length greater than or equal to 0.5um and an aspect ratio ≥ 3:1 will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

In all cases where a composite sample has been collected on more than one filter cassette (this is considered likely for most **Whole-Home Multi-Template** samples), all cassettes with the same sample index ID number will be combined at the laboratory during sample preparation and analyzed as one sample.

7.0 References

ASTM. 2003. Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Surface Loading. ASTM D5755-03. June 2003.

CDM. 2003. Modifications to Laboratory Activities. 1st Revised December 23, 2003 with ongoing updates.

EPA. 2003. Sampling and Analysis Plan for Indoor Dust, Revision 0. August 7, 2003.

ISO. 1995. Ambient Air – Determination of Asbestos Fibers – Direct Transfer Transmission electron Microscopy Method. ISO 10312:1995(E).

SRC and CDM. 2007. Draft Sampling and Analysis Plan for Indoor Air, Operable Unit 4, Libby, Montana, Superfund Site. April 18, 2007.